

FINAL REPORT
ENGINEERING SURVEY AND FEASIBILITY STUDY
MINE DRAINAGE POLLUTION ABATEMENT
STATE GAME LANDS NO. 117
WASHINGTON COUNTY, PENNSYLVANIA
PROJECT NO. SL-130-1

1.0 INTRODUCTION

Raccoon Creek is one of the major streams in southwestern Pennsylvania, draining an area of approximately 184 square miles. A major portion of this watershed has been extensively mined for coal over the past 100 years, initially by deep mining and more recently by strip mining of large areas. As a result of the number and extent of abandoned deep and strip mines in the watershed, Raccoon Creek and its tributaries are seriously polluted by acid mine drainage.

A principal source of acid water is the subwatershed of Burgetts Fork, a tributary which enters Raccoon Creek near Burgettstown (Figure 1). A report prepared by the Federal Water Pollution Control Administration, Upper Ohio Basin Office, in November 1968, states that Burgetts Fork contributes about 53,000 pounds per day acidity to Raccoon Creek. Of that total, approximately 10,000 pounds per day is contributed to Burgetts Fork by an unnamed tributary flowing into Burgetts Fork from the northwest at the north end of Burgettstown. The majority of the watershed of this unnamed tributary lies within the boundaries of State Game Lands No. 117 and has been extensively strip mined.

Game Lands No. 117 covers approximately 2930 acres (Figure 2). About 60 percent of this area drains to Burgetts Fork, 30 percent drains directly to Raccoon Creek, and 10 percent drains to the west to Harmon Creek. Approximately 375 to 400 acres of these Game Lands are severely disturbed by strip mining and require reclamation.

Since the Game Lands are publicly owned, reclamation can be done with Project 500 bond issue funds. E. D'Appolonia Consulting Engineers, Inc. (D'Appolonia) was retained by the Department of Environmental Resources to investigate the feasibility and cost of reclaiming the strip mined land within State Game Lands No. 117.

2.0 MINING HISTORY

Mining in the area of State Game Lands No. 117 removed the Pittsburgh coal. The Pittsburgh coal here dips to the south, outcropping on many hillsides north of Burgettstown. Further north, near Florence on U.S. Route 22, the coal rises until it outcrops entirely around hilltops. Due to the relatively shallow overburden, strip mining of large areas was economically feasible. South of Burgettstown, the coal dips deeper and strip mining gives way to deep mining. In the immediate Burgettstown area, the deep mines were drift entry type. South of Burgettstown, near Slovan, the deep mines were shaft entry with a depth of approximately 100 feet. Further south, at Atlasburg, the depth of mining reached 300 feet or more.

Details of the mining history of the area are limited. Apparently, the first mining in the Game Lands area was the extension of the Francis Mine in the southwest portion of the Game Lands by the GreensburgConnellsville Coal and Coke Company. Mine maps indicate this mining was conducted from several drift entries beginning in the early 1930s and continuing into the early 1940s. Either contemporary with or prior to the deep mining, the outcrops around the Francis Mine were stripped.

In the southeast portion of the Game Lands, deep mining was carried out by the Harmon Creek Coal Company, apparently during World War II. However, maps and dates of this mining are not available.

In the late 1950s or early 1960s, the entire area, including the abandoned deep workings of the Francis and Harmon Creek mines, was stripped by Starvaggi Industries (Weirton Ice and Coal Company and Pennweir Construction Company), the Harmon Creek Coal Company and Ray Bologna. Portions of these strip mines were regraded, particularly along the southwest boundary of the Game Lands, but large areas remained with steep spoil banks and water-filled final cuts.

3.0 FIELD INVESTIGATION

Based on a thorough study of the USGS topographic map covering the game lands (Burgettstown quadrangle) and recent aerial photographs of the area available from USGS, a detailed field investigation was initiated. To assist in the investigation, the available aerial photographs (taken in March 1969) and the topographic map were photo-enlarged to a scale of 1" = 400' and the topography superimposed on the aerial photographs. By referring to these photo maps in the field, locations and approximate elevations could be more accurately determined. Field observations were then marked on the maps as a convenient method of keeping field notes.

During the field investigation, the entire area of the Game Lands was covered on foot and important observations were noted on the photo map, including seepage areas, areas of significant ground surface disturbance, and areas of possible storm water ponding and infiltration. From these field observations, a map summarizing the conditions was developed (Figure 3). The map notes areas of significant acid mine seepage, areas of ponding, and the areas requiring regrading and reclamation.

4.0 WATER QUALITY SURVEY

A water quality survey was conducted to determine the quality of streams within the Game Lands and to locate the areas producing significant acid mine drainage. The results of the initial survey, made in December 1970, are shown in Figure 4. A second survey was made in June 1971 (Figure 5), and a limited number of key locations were sampled in May 1972 (Figure 5). Chemical testing of the first two sets of water samples was done by Seewald Laboratories of Williamsport, Pennsylvania, under a separate contract with the Department. The final few samples were tested in the D'Appolonia Water Quality Laboratory.

The water quality surveys basically verified the conclusions drawn from the field reconnaissance regarding areas requiring regrading and revegetation. Generally, all the streams in the Game Lands south of the new U.S. Route 22 were found to be acidic, while the streams in the northernmost portion of the State Game Lands north of U.S. Route 22 were alkaline.

The pollution loads flowing from the game lands based on these data are summarized in Table 1. The total pollution loads being discharged directly to Raccoon Creek were measured to be 280 to 1270 pounds per day acidity, 8 to 98 pounds per day iron, 2100 to 45,000 pounds per day sulfates. There was also 16 to 240 pounds per day alkalinity being discharged to Raccoon Creek from the northern portions of the Game Lands. The total pollution loads flowing to Burgetts Fork were measured to be 1750 to 2810 pounds per day acidity, 80 to 95 pounds per day iron, and 10,000 to 25,000 pounds per day sulfates. Small acidic discharges into tributaries of Harmon Creek on the western limits of the Game Lands were noted, but samples taken in Harmon Creek indicate the stream is alkaline, although with a very high hardness.

Additional data obtained in September, October, and December 1973 and January 1974 indicated that waters discharging from and flowing through the Game Lands were contributing approximately 2375 pounds of acidity

per day to Burgetts Fork and Raccoon Creek. Figure 6 shows the locations of the water quality sampling points and Table 2 summarizes the data collected at these locations. To facilitate the identification of the strip mined areas affecting each individual water quality sampling point, the total area was divided into drainage sub-basins which represent the approximate area of collection of surface runoff for most of the sampling locations (Figure 6). Although groundwater, which is an important consideration due to surface water infiltration and acid production in the subsurface, does not always follow paths indicated by surface contours, the assumption that it does usually provides reasonable approximations. Using these sub-basins, the quality of water from each area in the game lands was assessed.

The correlation of the sampling station numbers utilized in December 1970, June 1971, May 1972, and between September 1973 and January 1974 is indicated in Table 2A.

5.0 RECLAMATION PROCEDURES

Since there are no abandoned deep mines in the Game Lands, acid mine drainage abatement consists entirely of reclaiming strip mines. Reclamation to reduce acid mine drainage can basically be accomplished by burying acid-forming materials and regrading the surface to eliminate ponding, increase runoff rate, and minimize infiltration. The runoff rate must, of course, be controlled to prevent erosion, but terraced grading for erosion control tends to increase infiltration and thereby the production of acid mine drainage. In some areas, lined or rip-rapped channels are necessary to control erosion.

Streams and runoff must be diverted around areas of severe disturbance where acid-forming materials cannot be buried to minimize the amount of water coming in contact with these materials. Several streams in the Game Lands were found to be heavily silted, requiring excavation of the stream channels and, in some cases, rip-rap lining to control stream bed erosion.

The areas believed to require reclamation work were generally as outlined in Figure 3. The principal area requiring reclamation extended from the northwest corner of the Game Lands near Pennsylvania Route 18 to the east-southeast (Areas 3, 4, 5, 6, and 7 in Figure 3). This area was apparently the final cut in the stripping operations. A number of ponds existed in the upper (western) portion of the area and the water quality in the streams draining the lower portion was very bad, including not only acid water but serious siltation problems as well. The regrading work required along this two-mile-long strip included an area approximately 1500 feet by 2500 feet near the eastern boundary of the Game Lands. At the northern edge of this area is one of the few hilltops in the Game Lands not stripped, surrounded by a nearly vertical highwall 25 to 35 feet high (Area 5). A portion of the final cut around this hilltop was backfilled at some time with fly ash or similar waste material, which required burial prior to final regrading. The reclamation required in this area

was primarily regrading to eliminate ponding, Portions of the stream channel would require relocation, particularly in the upper end, and removal of silt. In some areas, rip-rap would be required in the stream channel to control erosion. The upper end of this area was outside the boundaries of the Game Lands, but reclamation was considered because it drained into the Game Lands.

Southwest of Route 18 was another large area requiring extensive regrading work (Areas 9, 10, 11, 15, 16, and 17). Again, a significant portion of the area lay along the stream channel, and much of the work would be channel improvement.

North of the new U.S. Route 22, only two small areas of significant disturbance was noted, but since the streams draining this area were alkaline, no reclamation work was recommended in this area.

As can be noted on the topographic map and aerial photographs, other areas have been stripped and not regraded where reclamation was not recommended. Field investigation indicated that no acid mine drainage was emanating from these areas and substantial vegetation in the form of grasses and trees, either naturally or artificially seeded, had developed and would be destroyed by regrading operations.

Based on the water quality data obtained in late 1973 and early 1974, reclamation requirements were reevaluated. The revised reclamation area included approximately 440 acres and it was estimated that reclamation of all these areas (Figure 3) would reduce the acidity discharge by up to 95 percent.

Sub-basins A, B, D, and H, as shown in Figure 6, including the Harmon Creek watershed, the area north of Route 22 and a small basin northeast of Burgettstown Community Park, were found to discharge waters possessing significant alkalinity. Therefore, stripped areas within these basins did not require reclamation efforts. Together, the streams from these areas contribute about 850 pounds per day alkalinity to Raccoon Creek

and Burgetts Fork and about 1500 pounds per day alkalinity to Harmon Creek.

Table 3 presents a summary of those sub-basins characterized by acid discharges, noting areas requiring reclamation and estimated reclamation costs and priorities. It was estimated that reclamation of Areas 5, 6, 9, 10, 11, 15, 16, 17, and 19 (Priorities 1 through 4) could effect acid abatement of up to 85 percent of the total acid contribution from the Game Lands or about 2000 pounds per day acidity. It was estimated that about 5.2 miles of stream would be improved.

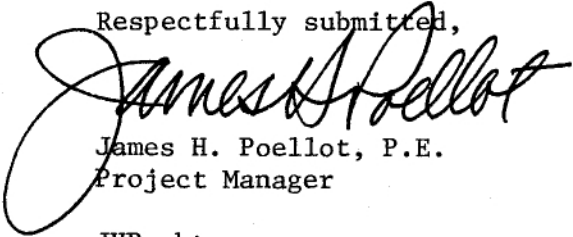
Based on the revised evaluations, design work on Priorities 1 through 4 was initiated in April 1974, using updated aerial topographic mapping provided in 1973 by L. Robert Kimball, Consulting Engineers. Final details of the reclamation were developed in cooperation with the Pennsylvania Game Commission, combining the requirements for acid mine drainage reduction and best use of the Game Lands. The complete construction drawings are attached as an appendix to this report. The reclamation work consisted primarily of regrading to improve runoff and decrease infiltration, elimination of ponds contributing to infiltration, and regrading and improving stream channels to increase drainage.

The engineer's estimate for the construction work was \$1,035,278. In June 1975, DER Contract No. SL 130-1-101.1 was awarded to Anjo Construction Company of Pittsburgh, the lowest of four bidders with a price of \$615,300. The construction work began in October 1975 and was completed in January 1977, at a final cost of \$721,536.

6.0 RECOMMENDATIONS AND CONCLUSIONS

Based upon the detailed field investigation and the estimated costs of various levels of reduction of the acid mine drainage originating in the State Game Lands No. 117, it was recommended that reclamation be undertaken in Areas 5, 6, 9, 10, 11, 15, 16, 17, and 19 (Priorities 1 through 4 in Table 3). It was estimated that reclamation of 220+ acres of the total of approximately 440+ acres in need of reclamation could reduce the acid mine drainage from State Game Lands No. 117 by up to 80 to 90 percent.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "James H. Poellot". The signature is written in a cursive style with a large, looping initial "J".

James H. Poellot, P.E.
Project Manager

JHP:mbt

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